CLAIMS

What is claimed is:

1. A method for determining a restoration path corresponding to a primary path for a new service in a mesh network having a plurality of nodes interconnected by a plurality of links, the method comprising:

for each of a plurality of candidate restoration paths associated with the primary path:

determining whether the primary path requires any additional restoration bandwidth to be reserved on any link of the candidate restoration path based on whether, for each link of the candidate restoration path, the primary path is SRLG-disjoint from each other primary path that is currently protected by that link, wherein:

a shared risk link group (SRLG) is a set of two or more links, for which a failure of any one link in the SRLG is associated with a relatively high risk of failure of the other links in the SRLG; and

two paths are SRLG-disjoint if no two links in the two paths are members of any one SRLG; and

generating a path cost for the candidate restoration path, wherein the path cost is a function of whether any such additional restoration bandwidth is required; and

selecting the restoration path for the new service based on the path cost for each candidate restoration path.

2. The invention of claim 1, wherein a failure of any one link in an SRLG is associated with a risk of failure of the other links in the SRLG greater than a specified risk threshold.

3. The invention of claim 1, wherein each candidate restoration path is SRLG-disjoint from the primary path.

4. The invention of claim 3, wherein, for each link in the primary path, the method comprises:

determining whether the link is part of an SRLG; and

if the link is part of an SRLG, then excluding any path having a link in that SRLG from consideration as a candidate restoration path.

5. The invention of claim 1, wherein, for each link in the primary path, the method comprises:

assigning a link cost to each link of each candidate restoration path;

reducing the link cost by a factor R for each link of each candidate restoration path for which sharing is possible;

generating a path cost for each candidate restoration path based on a sum of the link costs for the links of that candidate restoration path; and

selecting one of the candidate restoration paths for the primary path based on minimum path cost.

6. The invention of claim 5, wherein the factor R is a function of a sharing degree for each link.

7. The invention of claim 6, wherein, if sharing is not possible, then:

determining whether utilization of the link is greater than a specified threshold;

if the link utilization is greater than the specified threshold, then generating the link cost as a function of an administrative weight for the link and available capacity on the link; and

if the link utilization is less than the specified threshold, then generating the link cost as a function of the administrative weight for the link.

8. The invention of claim 6, wherein the link cost is also generated as a function of an administrative weight for the link.

9. The invention of claim 6, wherein the link cost is also generated as a function of a form of a sharing degree.

10. Then invention of claim 9, wherein the form of the sharing degree is an approximation to the sharing degree that is calculated using a binary representation of a node-link vector and a binary representation of a primary path node-link vector, wherein the calculation of the approximation comprises:

computing the bitwise AND of the binary representation of the node-link vector and the binary representation of the primary path node-link vector, and

computing the OR of all elements of the resulting vector to determine whether sharing is possible.

11. The invention of claim 1, wherein the sharability of a link in a candidate restoration path is represented by a sharing degree for the link, wherein the sharing degree is a maximum number of additional unit-bandwidth primary services that can be added to the candidate primary path without increasing restoration bandwidth reserved on the link.

12. The invention of claim 11, wherein the sharing degree SD for a link is given by:

SD = the maximum value m for which $\max\{m \cdot V_{pnl} + V_{nla}\} = \text{RB}$,

wherein:

V_{pnl} is a primary path node-link vector for the corresponding candidate primary path;

V_{nla} is an aggregate node-link vector for the link; and

RB is current reservation bandwidth on the link.

13. The invention of claim 1, wherein the method is implemented for each of a plurality of candidate primary paths to generate a path pair cost associated with the candidate primary path and further comprising selecting one of the candidate primary paths for the new service based on minimum path pair cost.

14. The invention of claim 13, wherein the plurality of candidate primary paths comprises:

K minimum-cost paths for the new service where the path cost is calculated as a function of the link costs, and the link costs are calculated by:

determining whether utilization of the link is greater than a specified threshold;

if the link utilization is greater than the specified threshold, then generating the link cost as a function of an administrative weight for the link and available capacity on the link; and

if the link utilization is less than the specified threshold, then generating the link cost as a function of the administrative weight for the link.

15. A network manager for a mesh network having a plurality of nodes interconnected by a plurality of links, the network manager adapted to determine a restoration path corresponding to a primary path for a new service in the mesh network, wherein:

for each of a plurality of candidate restoration paths associated with the primary path:

the network manager is adapted to determine whether the primary path requires any additional restoration bandwidth to be reserved on any link of the candidate restoration path based on whether, for each link of the candidate restoration path, the primary path is SRLG-disjoint from each other primary path that is currently protected by that link, wherein:

a shared risk link group (SRLG) is a set of two or more links, for which a failure of any one link in the SRLG is associated with a relatively high risk of failure of the other links in the SRLG; and

two paths are SRLG-disjoint if no two links in the two paths are members of any one SRLG; and

the network manager is adapted to generate a path cost for the candidate restoration path, wherein the path cost is a function of whether any such additional restoration bandwidth is required; and

the network manager is further adapted to select the restoration path for the new service based on the path cost for each candidate restoration path.

16. The invention of claim 15, wherein the network manager is distributed over the network.

17. The invention of claim 15, wherein the network manager is located at a single node of the network.